METHOD AND EQUIPMENT FOR MAKING ADJUSTMENT SHAFTS

The present invention relates to a method and to equipment for making adjustment shafts as defined in claim 1 respectively claim 7.

Adjustment shafts of the above kind are used in the form of a flexibly emplaceable adjustment means, in particular to transmit torques between a position transmitter that can be connected to one of the free shaft ends and a position receiver which can be connected to the other free shaft end; emplacement takes place for instance in cavities of motor vehicle parts. To abate noise between the moving adjustment shafts on one hand and the surrounding housing parts on the other hand, in particular automobile sheetmetal parts, the actual metallic shafts are strands and are enclosed by an acoustically damping external cladding, in particular textile flocks.

Such flock-coated adjustment shafts having free ends are manufactured from lengths of shaft strands, fitted continuously with an external cladding, by severing strand segments corresponding to the axial length desired of a specific adjustment shaft and by ridding the shaft ends needed for torque connection from the external cladding and shaping of said shaft ends if required.

The objective of the present invention is an easily handled simple manufacture of adjustment shafts which are acoustically damped between their free metallic ends by external cladding.

This problem is solved advantageously by a method defined in claim 1 and equipment defined in claim 7; advantageous implementing modes of the method are defined in the dependent claims 2 through 6 and advantageous equipment embodiment modes are defined in claims 8 through 11.

The method and the equipment of the present invention permit simple and reliable manufacture -- which can be automated -- and employ a continuous metal shaft strand fitted with an external cladding, and they make it possible to brush clean each zone of the shaft end which must be kept rid from said external cladding in purposeful manner, assuring quality of work; appropriately the zone to be kept cladding-free runs over two adjoining

shaft ends of two consecutive shafts-to-be that shall be severed from one another only after their junction has been brushed clean and that, if necessary, are fitted with a geometrically interlocking torque coupling shape.

Short working times with compact designs are attained in particular in that two radially opposite brushes act as rotating brushes on the shaft length to be brushed clean and in that said brushes are tangentially pivotable about the metal strand for the purpose of a progressive elimination of the external cladding on it; this procedure is implemented by an advantageous design whereby the rotating brushes are received in a support concentric with the strand and rotatable about it, in particular in a brush head.

The invention and further implementing/embodying modes of the dependent claims are elucidated below by means of illustrative examples and in relation to the appended drawings.

Fig. 1 is an axial section in elevation of equipment of the invention to manufacture adjustment shafts of which the ends have been rid of the external cladding,

Fig. 2 is a section II-II of the equipment of Fig. 1,

Fig. 3 is an adjustment shaft of which the external cladding has been removed at both shaft ends,

Fig. 4 is a continuous strand comprising two zones where the external cladding has been removed and also shows brushes moved toward one of these zones,

Fig. 5 is an enlarged view of an end-face topview on the left end face of the adjustment shaft of Fig. 3, and

Fig. 6 is an enlarged end-face view of the left end-face section of the strand along line VI-VI of Fig. 4.

The equipment of the invention shown in Figs. 1 and 2 comprises a first, right-hand axial guide 12 comprising position affixing means and, an axial free space away, a second, left-hand axial guide 13 also fitted with position fixing means for a shaft strand 3 (not shown here) of Fig. 4 that can be fixed in a brushing position.

Two rotating and mutually faced braced brushes 4 and 5 are configured in the clear space between the right-hand and left-hand position fixing means and can be moved radially toward the peripheral surfaces of the shaft strand; the brushes 4 and 5 are driven by the drive elements 4.2; 5.2 of electric motors 8; 9, said drive elements being configured radially parallel to the longitudinal axis predetermined by the guides 12, 13.

In one embodiment mode of the present invention, the brushes 4, 5 are respectively radially displaceable along radial guide rails 6.1, 6.1 by drive units 4.3, 5.3 and thereby, in a further embodiment mode of the present invention, they may be moved radially toward the shaft strand, for the purpose of removing the external cladding, a distance such that the tips of the bristles 4.1, 5.1 of the brushes 4, 5 barely reach the peripheral surface of the free shaft ends during operation, that is at maximum rotational speed.

Appropriately only a support in the form of an oppositely located support roller is used when there is only a single rotating brush.

The total brushing apparatus inclusive the brush drive unit and brush adjustment means is received in a pivotably supported brush head 6 configured concentrically with the axial guides 12; 13 and hence with the shaft strand in a fixed housing 7. In one design of the present invention, the brush head 6 is pivotably supported relative to the housing 7 so as to be driven externally from a drive unit 11 whereby, using only a minimum of flexible power and control lines, the entire external surface of the shaft strand can be rid of the external cladding in the region of the shaft ends to be bared.

In a further implementation of the present invention attaining high flexibility regarding different flocks by means of the external cladding or different lengths of the bare shaft ends, the brush head 6 is made axially displaceable and its seating is provided along axial guide rails 10 in relation to the shaft strand to be received by the guide 12.

Fig. 3 is a sideview and Fig. 5 is a front view of a finished adjustment shaft 1 fitted with an external cladding 1.3 between the free shaft ends 1.1 and 1.2 from which said cladding has been abraded by the brushes; said finished shaft 1 was made from a shaft strand 3 that was unwound from a supply roll for instance and that was continuously

covered with an external cladding. This abrasion procedure is also shown schematically in Figs. 4 and 6.

Rotating brushes 4; 5 are moved toward a fairly long shaft strand 3 continuously fitted with an external cladding in a manner that the tips of the brush bristles 4.1; 5.1 abrade the cladding down to the peripheral surface of the inner, stranded metallic shaft. Advantageously the brushes 4; 5 are pivotable in concentric and arcuate manner relative to the shaft strand so that the brushes 4; 5 can process the peripheral surface from all around them.

In a further design of the present invention, the brush head 6 and hence the brushes 4; 5 are displaceable in such manner in the direction of the shaft strand that, regardless of brush width, arbitrary lengths of bared shaft ends can be made, for instance by merely shifting in timed manner the operational range of the brush system.

The left part of Fig. 4 shows a finished brush zone a; b advantageously consisting of two consecutive shaft ends 1.2; 2.1 of an adjustment shaft 1 and a consecutive adjustment shaft 2, said brush zone having a length zone a for the shaft end 1.2 of the adjustment shaft 1 and a length zone b for the shaft end 2.1 of the adjustment shaft 2; by dividing the originally continuous brush zone a; b at the transition zone, the adjustment shaft 2 is separated from the shaft strength 3 and thereby from the adjustment shaft 1.

The essential concept of the present invention may be summarized as follows:

To manufacture adjustment shafts 1; 2 fitted with a noise-abating external cladding 1.3; 2.3 and shaft ends 1.1; 1.2; 2.1 bared from such cladding, rotating brushes 4;5 are moved within a brush unit toward an inserted shaft strand 3 which is continuously fitted with said cladding that then is removed from the shaft end zones by being abraded by said brushes; appropriately in each such procedure one continuous zone a; b of the shaft ends of two consecutive and adjoining adjustment shafts is abraded clean by the said brushes,, whereupon the two shaft ends are severed from one another.